



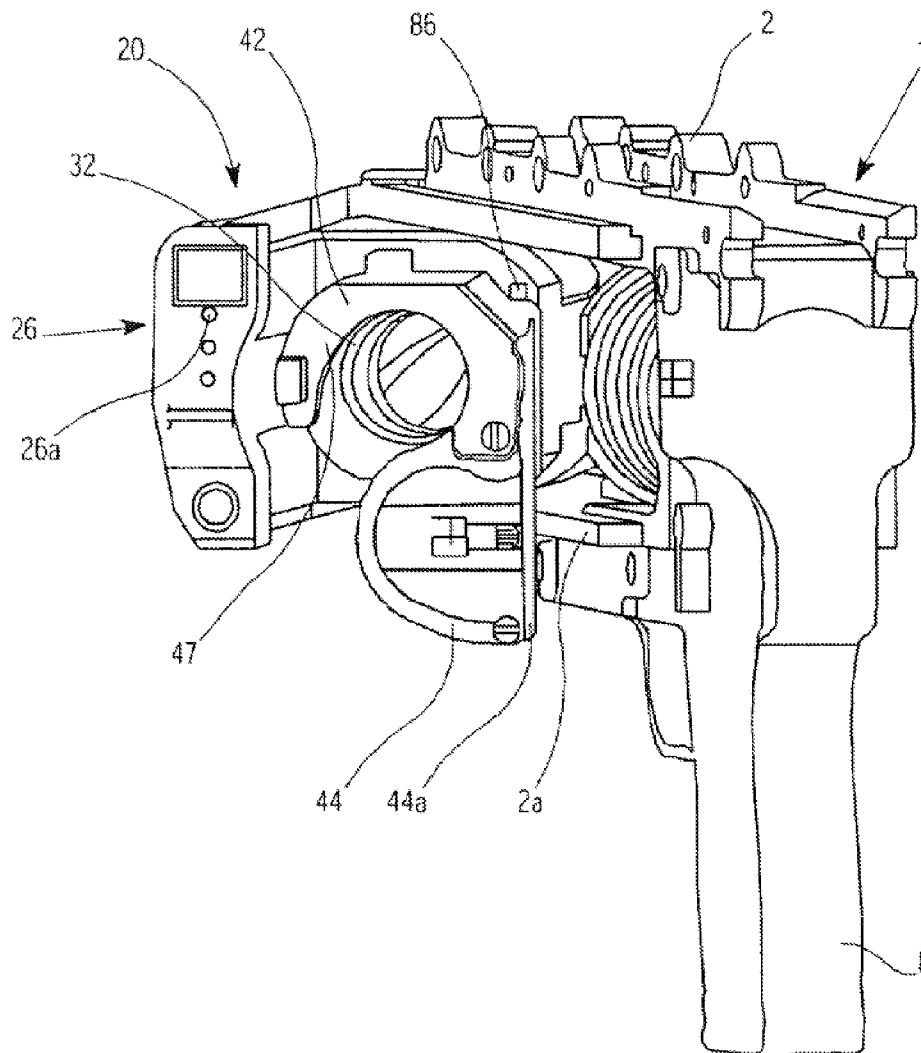
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(19) **United States**(12) **Patent Application Publication**
Murello(10) **Pub. No.: US 2010/0192439 A1**(43) **Pub. Date: Aug. 5, 2010**(54) **DAMPER APPARATUS FOR USE WITH
FIREARMS**(30) **Foreign Application Priority Data**

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(76) Inventor: **Johannes Murello, Deisslingen
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HANLEY, FLIGHT & ZIMMERMAN, LLC
150 S. WACKER DRIVE, SUITE 2100
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F41A 19/39 (2006.01)(52) **U.S. Cl. 42/1.06; 89/25; 42/105; 89/177**(57) **ABSTRACT**

Damping apparatus for use with firearms are described herein. An example firearm described herein includes a barrel assembly mounted in a frame of the firearm. A damper apparatus is axially disposed between a breech assembly and a portion of the frame of the firearm opposite a muzzle end of the barrel assembly, wherein the damper apparatus is operatively coupled to the barrel assembly and slidably receives a firing pin guide.

(21) Appl. No.: **12/506,775**(22) Filed: **Jul. 21, 2009****Related U.S. Application Data**(63) Continuation of application No. PCT/EP2008/
000230, filed on Jan. 14, 2008.

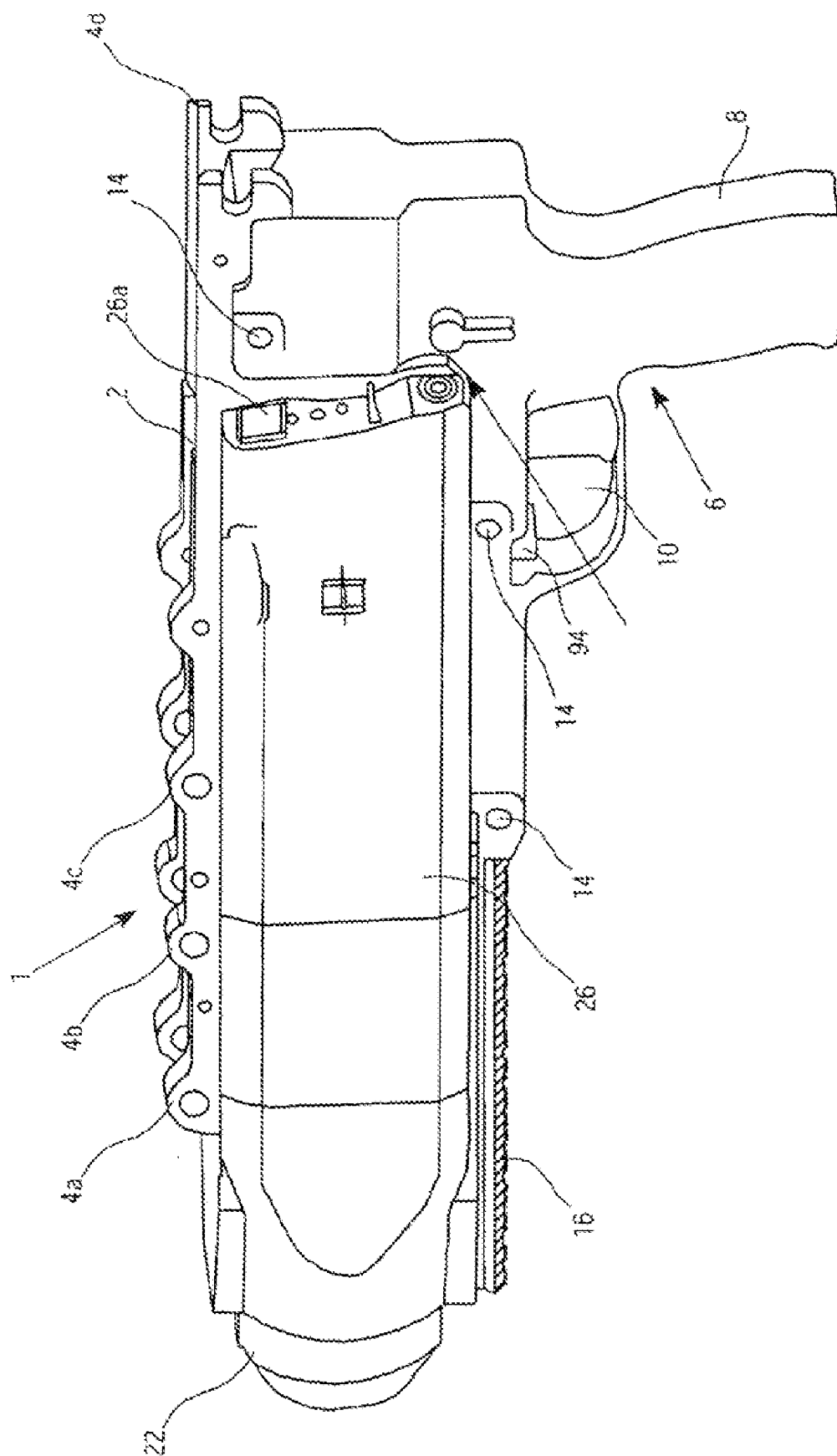


FIG 7

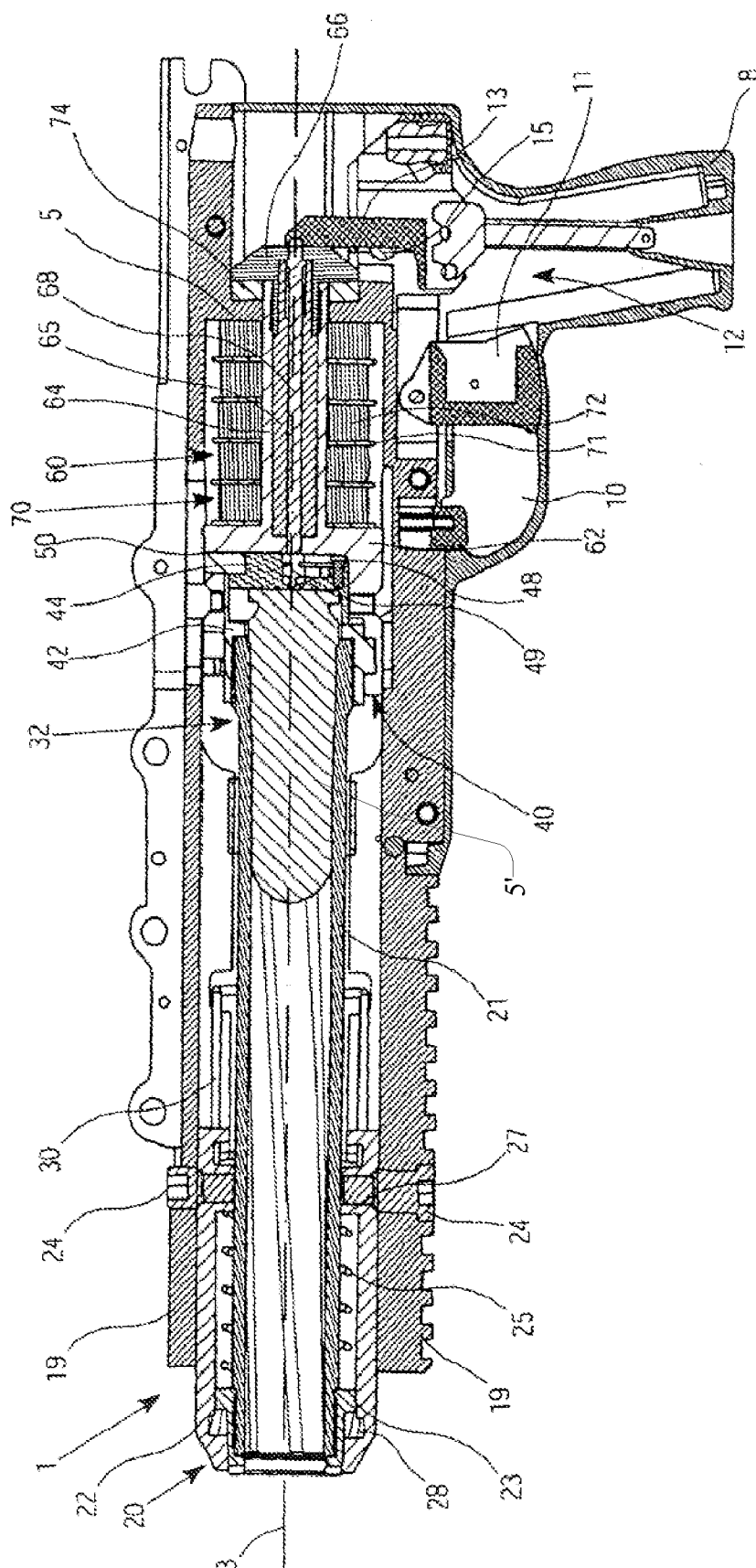


FIG. 2

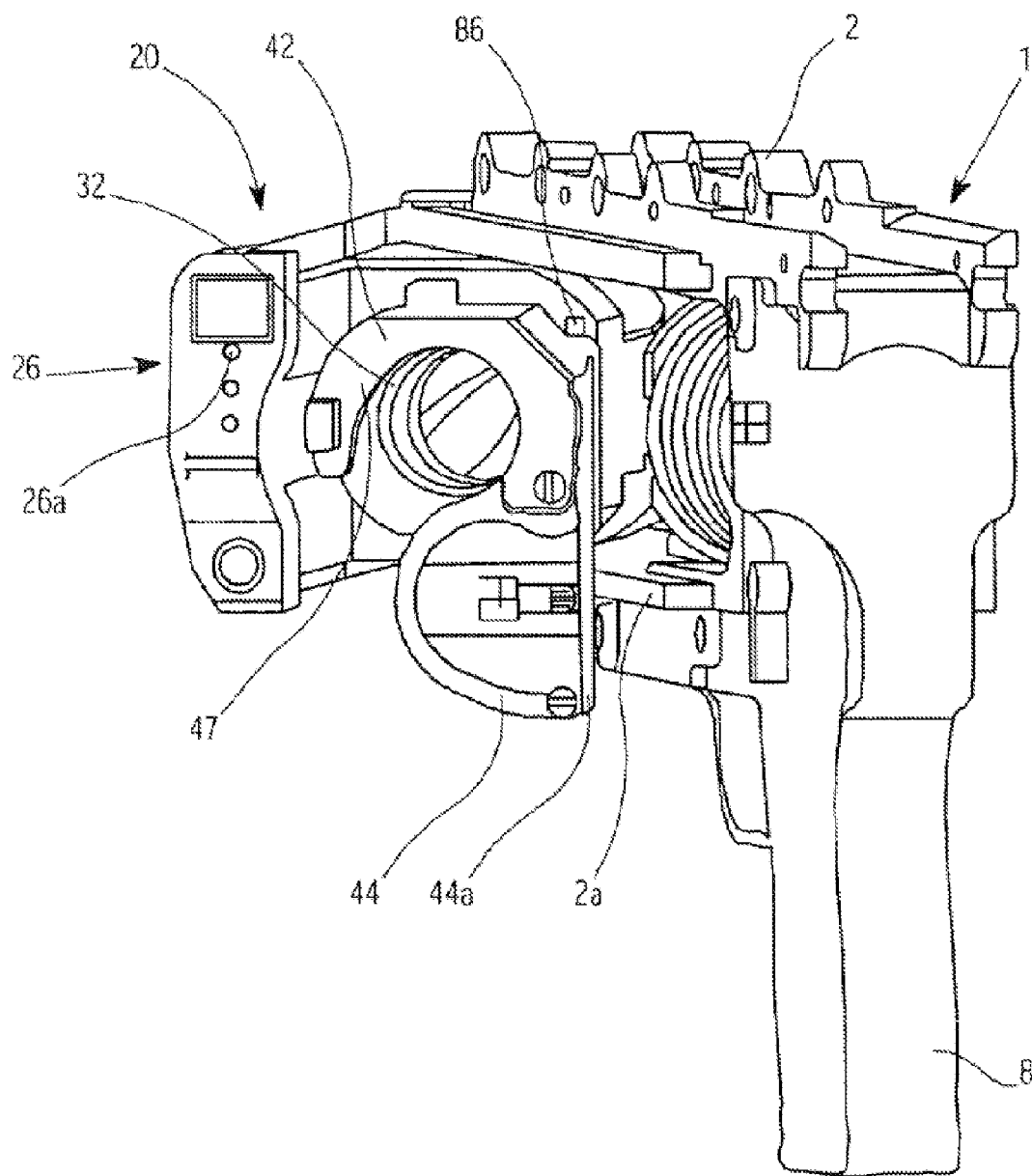


FIG. 3

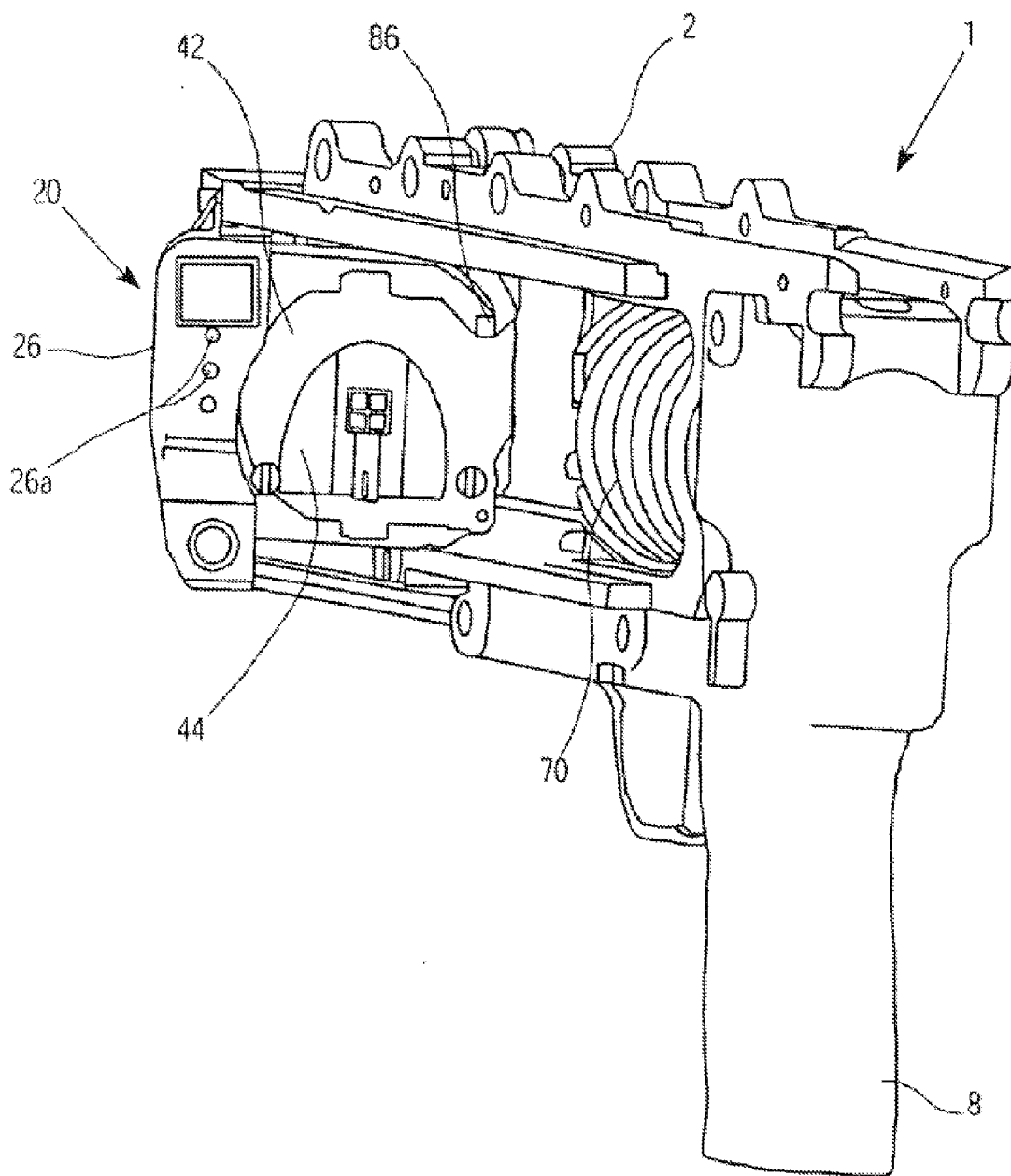
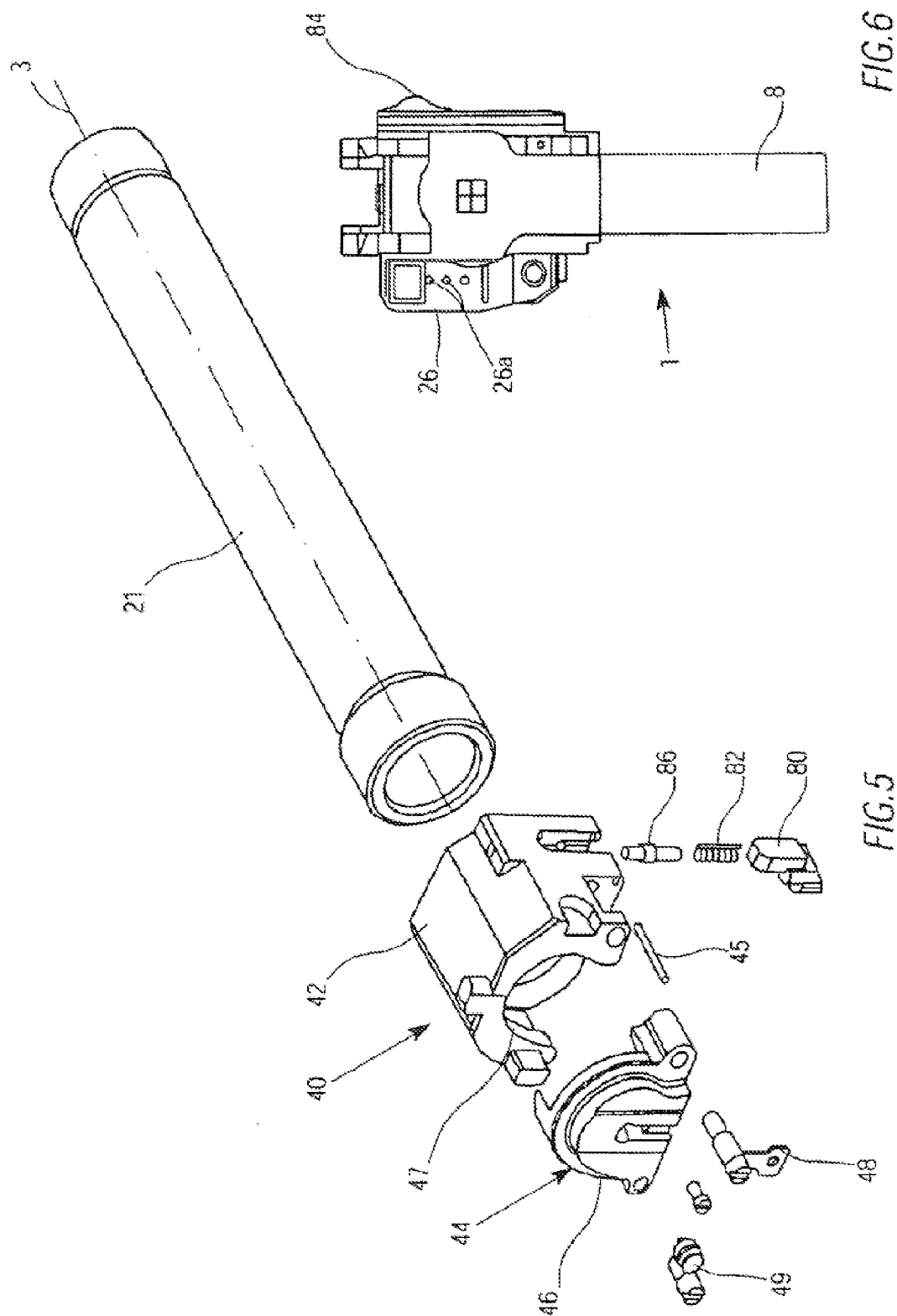


FIG. 4



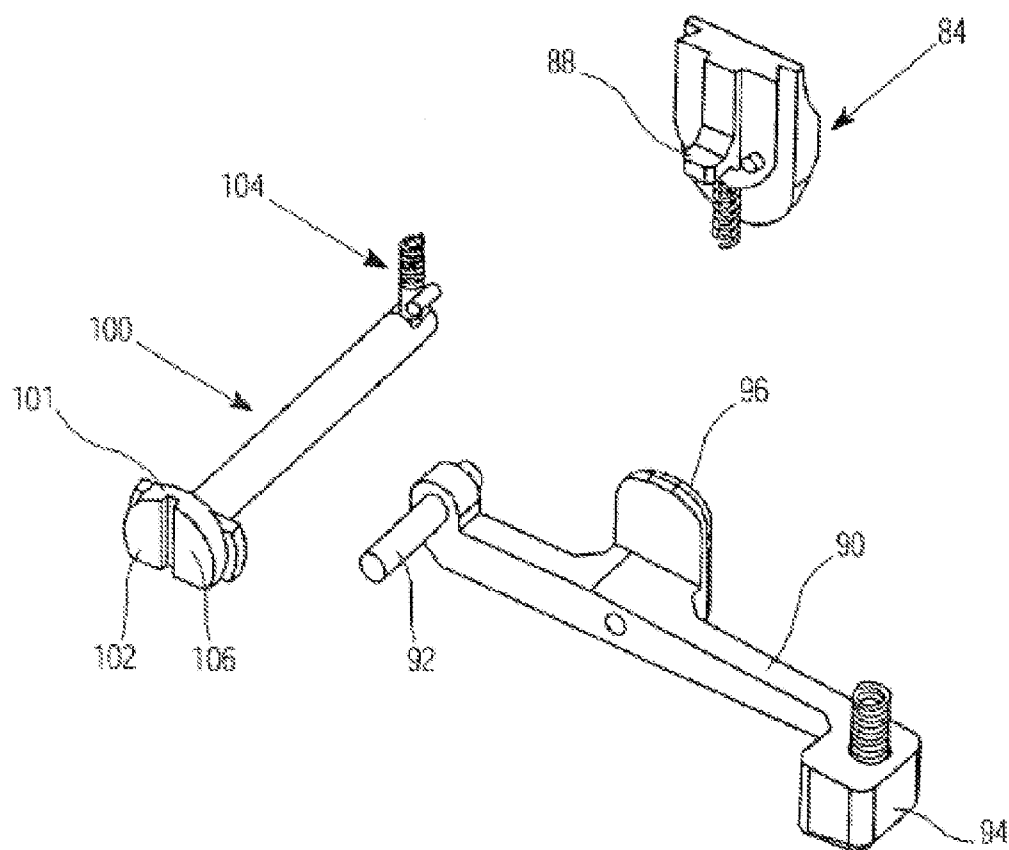


FIG. 7

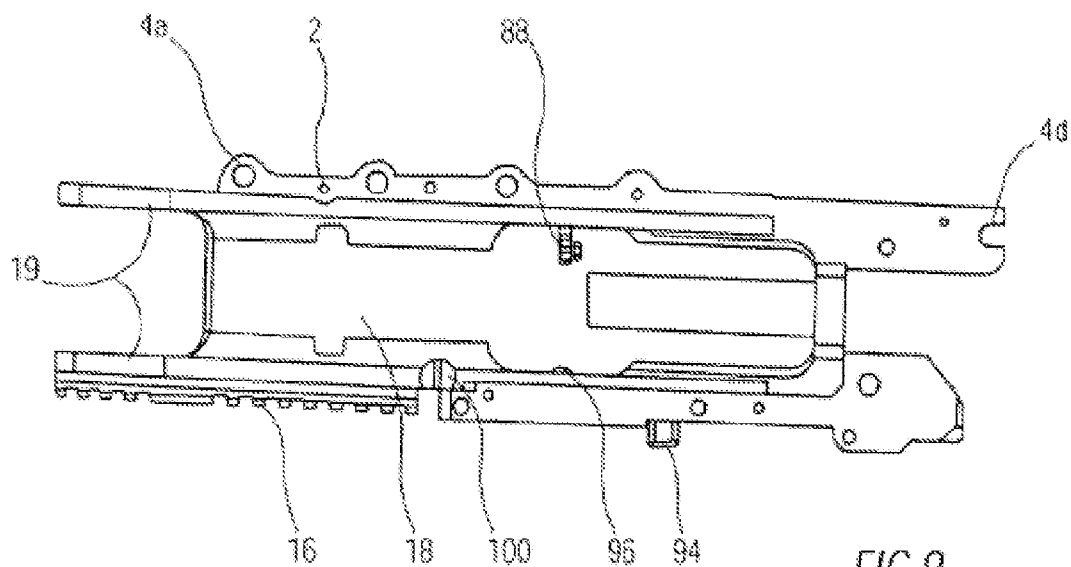


FIG. 8

DAMPER APPARATUS FOR USE WITH FIREARMS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent is a continuation of International Patent Application Serial No. PCT/EP2008/000230, filed Jan. 14, 2008, which claims priority to German Patent Application 10 2007 003 180.9, filed on Jan. 22, 2007, both of which are hereby incorporated herein by reference in their entireties.

FIELD OF THE DISCLOSURE

[0002] The present disclosure relates generally to damper apparatus and, more particularly, to damper apparatus for use with firearms.

BACKGROUND

[0003] Generally, firearms or weapons (e.g., grenade launchers, automatic and semi-automatic assault firearms, etc.) have movable component parts that move in response to a gas pressure produced when discharging a firearm. Movement of the component parts (e.g., a barrel) often cause a recoil force or effect. In some instances, the recoil effect may tend to cause the user of the firearm to jerk the firearm out of alignment of an intended target, which may cause the user to miss the intended target. To cushion or reduce the recoil effect, firearms are typically implemented with a damping arrangement or apparatus.

[0004] For modern small arm systems (e.g., a grenade launcher), there is an increasing demand to fire large caliber ammunition (e.g., 25 millimeter (mm), 40 mm ammunition) at projectile impulse rates that are greater than 25 N/s. Such projectile impulse rates are substantially greater compared to conventional projectile impulse rates of 13 N/s. However, a firearm that generates projectile impulse rates that are greater than 25 N/s may be difficult to use due to the recoil effect imparted on the firearm upon discharge without the use of an effective mounting (e.g., a stand).

[0005] Thus, for large caliber small arms such as a grenade launcher, a damper apparatus is typically provided to significantly reduce or minimize recoil effects experienced by a user upon firing of the firearm. In some known large caliber small arms, a barrel assembly is typically fixedly mounted to a housing or frame of the firearm such that a barrel can move in an axial direction relative to a housing during discharge of the firearm. A cartridge chamber is accessed via the rear of the firearm to load and/or unload the firearm.

[0006] In these known configurations, a damper apparatus is typically disposed between a housing assembly and a barrel assembly of the firearm. In some examples, the damper apparatus may include a spring such as an elastomeric ring spring assembly that is disposed between the barrel and the housing. Such an example firearm is described in European Patent 0911533. In yet another example, a damper apparatus includes disk springs that surround a barrel mounted to a housing of the firearm and disposed between the barrel and the housing. Such an example damper apparatus is described in U.S. Pat. No. 4,689,912.

[0007] A firearm having a long barrel length may be implemented with a longer, but smaller sized (e.g., a smaller diameter spring) damper apparatus to provide sufficient damping. In contrast, for firearms having shorter barrels, a larger sized damper apparatus (e.g., a larger diameter spring) is often used

to effectively provide sufficient damping to minimize recoil action produced by larger caliber ammunition (e.g., 20 mm to 40 mm cartridges). However, such larger damping apparatus typically require an enlarged portion or space in the firearm housing to accommodate the barrel and the damper apparatus, thereby increasing the overall envelope of the firearm. Thus, such a configuration is undesired due to space constraints and/or enlarging the size of the firearm.

[0008] Large caliber small firearms (e.g., a rifle grenade launcher) may be implemented with a recoil brake or recoil damper that includes, for example, a rubber portion or body, a spring, or a fluid brake. Such recoil brakes are often disposed between a breech block region of the firearm and a support portion of a frame or housing. Such an example damper apparatus is described in German Patent 717,000.

[0009] However, such known damper apparatus are not effective when employed with firearms having “swing type” barrels that pivot transversely relative to a housing of the firearm. Such known damper apparatus noted above often may not be used with “swing type” barrels without making substantial modifications to the housing of the firearm, thereby increasing cost and complexity. Thus, large caliber small firearms having “swing type” barrels are often not implemented with a damping apparatus. Such example firearm is described in German publication 10 2005 019 594.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] FIG. 1 illustrates an example firearm described herein having a barrel assembly of the firearm in a locked, firing position.

[0011] FIG. 2 illustrates a cross-sectional view of the example firearm of FIG. 1.

[0012] FIG. 3 illustrates another view of the example firearm of FIGS. 1 and 2 showing the barrel assembly of the firearm of FIGS. 1 and 2 in a loading position and a cover of the example firearm in an open position.

[0013] FIG. 4 illustrates another view of the example firearm of FIGS. 1, 2 and 3, showing the barrel assembly in the loading position and cover in a closed position.

[0014] FIG. 5 illustrates an exploded view of a portion of the example barrel assembly of the example firearm of FIGS. 1-4.

[0015] FIG. 6 illustrates a rear view of the example firearm of FIGS. 1-4.

[0016] FIG. 7 illustrates an example locking mechanism of the example firearm of FIGS. 1-4.

[0017] FIG. 8 illustrates an example frame portion of the example firearm of FIGS. 1-4.

DETAILED DESCRIPTION

[0018] Certain examples are shown in the above-identified figures and described in detail below. In describing these examples, like or identical reference numbers are used to identify common or similar elements. The figures are not necessarily to scale and certain features and certain views of the figures may be shown exaggerated in scale or in schematic for clarity. Additionally, several examples have been described throughout this specification. Any features from any example may be included with, a replacement for, or otherwise combined with other features from other examples. Further, throughout this description, position designations such as “above,” “below,” “top,” “forward,” “rear,” “left,” “right,” etc. are referenced to a firearm held in a normal firing

position (i.e., wherein the “shooting direction” is pointed away from the marksman in a generally horizontal direction) and from the point of view of the marksman. Furthermore, the normal firing position of the firearm is always assumed, i.e., the position in which the barrel runs along a horizontal axis.

[0019] In general, an example firearm described herein includes a “swing type” barrel that is implemented with a damping apparatus to significantly reduce recoil effect of the firearm. The firearm may be a larger caliber firearm (e.g., having 25 mm to 40 mm ammunition) such as, for example, a grenade launcher. More specifically, the example damper apparatus can withstand high projectile impulse rates (e.g., greater than 25 N/s) for larger caliber ammunition (e.g., greater than 25 mm ammunition). Additionally or alternatively, an example firearm described herein includes a barrel assembly that is interchangeable with a second barrel assembly that can accommodate, for example, larger caliber ammunition than the first barrel assembly.

[0020] In particular, in certain examples the damper apparatus is disposed or arranged within a frame portion of the firearm between a breech block region of the barrel assembly and a support region of the firearm frame. In this manner, the barrel assembly may be pivotally mounted relative to the firearm frame. Such a configuration enables the barrel assembly (e.g., a bore guide and/or a barrel vice) to be spatially and functionally disposed within the housing relative to the damping apparatus.

[0021] Additionally, such a configuration enables the barrel assembly to have fewer parts and a less complex design, thereby significantly reducing costs to manufacture, maintain, and/or repair the barrel assembly. Additionally, the barrel assembly may be interchanged or replaced with a second barrel assembly that is sized substantially similar, smaller, or larger than the barrel assembly being replaced. In this manner, the damper apparatus and/or a buffer apparatus are operatively coupled to, and spaced part from, the barrel assembly (e.g., a cartridge receptacle, a seating of the projectile, etc.). Such configuration enables the firearm to accommodate differently sized barrels while providing a small envelope or size.

[0022] Additionally or alternatively, arranging the damper apparatus and/or a buffer apparatus in spaced apart relation from the barrel assembly enables the radial or peripheral space around the barrel assembly to be used to receive data transmission devices (e.g., programming coils) for use with smart ammunition. Additionally or alternatively, the firearm can be used to accommodate larger caliber ammunition (e.g., greater than 40 mm) without having to increase the space or bore of a frame portion of the firearm. Thus, the overall envelope of the firearm can be reduced to provide a compact, slim, and versatile firearm having effective recoil damping.

[0023] FIG. 1 illustrates an example firearm 1 described herein. The firearm 1 includes a first frame portion or housing assembly 2 and a second frame portion or housing assembly 6. In this example, the first frame portion 2 includes interfaces 4a-4d to enable mounting of the firearm 1 to a portion of a second or carrier firearm (not shown) such as, for example, an assault rifle or rapid fire firearm. For example, the firearm 1 can be coupled to (e.g., hooked to) a corresponding receptacle (e.g., a gas port) of the carrier weapon (not shown) via a cotter pin. Alternatively, the interfaces 4a-4d can be used to mount, for example, a shoulder support, a sight apparatus, etc., to the

first frame portion 2. The first frame portion 2 may also include a Picatinny rail 16 (e.g., at an underside of a frame portion).

[0024] In this example, the second frame portion 6 includes a grip portion 8 and a trigger assembly 10. The second frame portion 6 is coupled to the first frame portion 2 via corresponding pins 14 (e.g., cotter pins).

[0025] FIG. 2 illustrates a cross-sectional view of the example firearm 1 shown in FIG. 1. Referring also to FIG. 2, one end of the first frame portion 2 (e.g., the right end) includes a closed portion or wall. A swivel mount 19 is coupled to a second end of the first frame portion 2 opposite the first end. A mounting sleeve 22 is pivotally mounted to the swivel mount 19 via a hinge pin 24. The hinge pin 24 has an axis that is substantially perpendicular to an axis 3 of the firearm 1.

[0026] In this example, the firearm 1 includes a “swing type” barrel assembly 20. The barrel assembly 20 is pivotally coupled to the first frame portion 2 and is disposed within a recess or receptacle formed in the first frame portion 2. The barrel assembly 20 is aligned along the axis 3 and pivotally coupled to the first frame portion 2 via the swivel mount 19, the mounting sleeve 22, and the hinge pin 24. The “swing type” barrel assembly 20 facilitates loading of the firearm and improves maintenance.

[0027] The barrel assembly 20 includes a barrel 21, a guide sleeve 23, and an electronic unit 26. In this example, the guide sleeve 23 is threadably coupled to a muzzle end of the barrel 21. The barrel 21 is coupled to or guided within the mounting sleeve 22 via the guide sleeve 23, which engages a recoil spring 25. The recoil spring 25 is disposed between a shoulder 27 of the mounting sleeve 22 and the guide sleeve 23 to bias the barrel 21 toward a buffer ring 28 disposed adjacent the muzzle end of the barrel 21.

[0028] In this example, a pivot spring 30 is disposed within the first frame portion 2 and is operatively coupled to the barrel assembly 20. The pivot spring 30 supports itself within the first frame portion 2 and is operatively coupled to or engages the barrel assembly 20 adjacent the hinge pin 24. The pivot spring 30 engages or biases the barrel assembly 20 laterally relative to the first frame portion 2 so that the barrel assembly 20 pivots or moves about the hinge pin 24.

[0029] As shown, the second end of the barrel 21 includes the electronic unit 26. In this manner, the electronic unit 26 can pivot with the barrel 21 relative to the first frame portion 2. The electronic unit 26 includes a display and/or a control element 26a to enable a user to program, for example, target data. Thus, programmable or intelligent ammunition 5' can be used with firearm 1.

[0030] Also, the second end of the barrel 21 is coupled (e.g., threadably coupled) to a breech assembly 40 adjacent a cartridge chamber or region 32. FIG. 5 illustrates an exploded view of the example barrel assembly 20 and the breech assembly 40. Referring also to FIG. 5, the breech assembly 40 includes a breech block 42 having a cover 44 pivotally coupled to the breech block 42 about a pin 45 (FIG. 5). The pin 45 does not absorb mechanical stresses imparted on the firearm 1 during discharge. The breech assembly 40 also includes a firing pin head 49 that is coupled to the cover 44. A spring 48 (e.g., a leaf spring) axially aligns the firing pin head 49 with the axis 3.

[0031] The first frame portion 2 also supports or accommodates a damper apparatus 60. As shown, the damper apparatus 60 is adjacent rear surfaces of the breech block 42, the cover

44, and the firing pin head 49 at a plane 50. Because the firing pin head 49 is coupled to the cover 44, the barrel assembly 20 is disposed in a spaced apart relation relative to the damper apparatus 60. In this manner, the barrel assembly 20 may be decoupled or removed from the damper apparatus 60 and/or the breech assembly 40. Thus, the breech assembly 40 provides an interface configuration to operatively couple the barrel assembly 20 and the damper apparatus 60. This interface arrangement between the breech assembly 40, the barrel assembly 20 and the damper apparatus 60 enables decoupling of the barrel assembly 20. Also, such an interface between the barrel assembly 20, the breech assembly 40, and/or the damper apparatus 60 provides a substantially free backlash load transfer during firing or discharge of the firearm 1 when they are coupled together and disposed within the first frame portion 2.

[0032] Additionally or alternatively, arranging the damper apparatus 60 in spaced apart relation from the barrel assembly 20 reduces the overall size of the first frame portion 2. For example, the size of the recess or receptacle may be reduced to receive the barrel assembly 20 compared to a recess or receptacle required if a damping apparatus surrounded the barrel assembly 20. Additionally or alternatively, such a configuration enables the radial or peripheral space around the barrel assembly 20 to be used to receive data transmission devices (e.g., programming coils) for use with smart ammunition. In this manner, the firearm 1 can be used to accommodate larger caliber ammunition (e.g., greater than 25 mm caliber) without having to increase the receptacle or bore of the frame portion 2 of the firearm 1. Thus, the overall envelope of the firearm 1 can be reduced to provide a compact, slim, and versatile firearm 1 having effective recoil damping.

[0033] The damper apparatus 60 includes a plate 62 from which a guide sleeve 64 extends or protrudes. The guide sleeve 64 receives or guides a firing pin guide 65 and guides the damper apparatus 60 in a direction along the axis 3. In this example, the firing pin guide 65 includes an adjustable head 66 that is coupled to the guide sleeve 64 via a fastener (e.g., a screw). A firing pin 68 is disposed within the firing pin guide 65 and is guided by the firing pin guide 65. A first or front portion of the firing pin 68 moves through an opening of the plate 62 adjacent the plane 50 so that the firing pin 68 engages the firing pin head 49 of the breech assembly 40. A second or rear portion of the firing pin 68 protrudes from a bore or opening of the adjustable head 66. As shown, the firing pin 68 is axially displaceable and spring loaded.

[0034] A recoil spring 70 is disposed between the plate 62 and a support region 5 of the first frame portion 2 and surrounds the guide sleeve 64. In this example, the recoil spring 70 is an elastomeric spring that includes annular guides 71 and damping elements 72. The guide elements 71 may be made of metal, plastic or any other suitable materials. The damping elements 72 may be made of an elastomeric material such as, for example, a Polyurethane foam or any other suitable material. As shown, the annular guides 71 are alternately arranged relative to the damping elements 72 such that a damping element is disposed between first and second guide elements.

[0035] The second frame portion 6 includes a grip 8, the trigger assembly 10, and a cartridge ejection mechanism 12. The cartridge ejection mechanism 12 is operatively coupled a hammer 13. The hammer 13 is spring-loaded and is actuated by a user via a trigger 11. The trigger 11, when pulled or activated, causes the hammer 13 to strike or engage the por-

tion of the firing pin 68 adjacent the adjusting head 66. When the trigger 11 is pulled, the cartridge ejection mechanism 12 causes the hammer 13 to strike the end of the firing pin 68 adjacent the adjusting head 66. The hammer 13 causes the firing pin 68 to move toward the muzzle end of the barrel 21 to strike or engage the firing pin head 49 via the plate 62 of the breech assembly 40. The firing pin head 49, having an ignition tip or end through the cover 44 adjacent the cartridge chamber 32, strikes or engages the ammunition 5' in the barrel 21. The propellant charge catapults the projectile out of the barrel 21 in the direction of the target.

[0036] The barrel assembly 20 (along with the breech assembly 40) pivots between a closed or firing position and an open or reloading position. In general, a "swing type" barrel assembly facilitates reloading of large caliber ammunition (e.g., 25 mm caliber, 40 mm caliber, etc.) and/or removal of a spent cartridge shell.

[0037] In other examples, the barrel assembly 20 can pivot from either side (e.g., the left side or the right side) of the firearm 1 or in an upward or downward direction relative to the first frame portion 2. Such configurations provide flexibility to enable the firearm 1 to be attached to various other weapons or firearms. For example, a barrel assembly 20 that pivots laterally relative to a side of the first frame portion 2 enables the firearm 1 to be coupled to a side surface or a bottom surface of a carrier weapon or firearm. Additionally, the pivotability of the barrel assembly 20 relative to the first frame portion 2 enables hand grips for loading the firearm 1 to be disposed on the firearm 1 such that a user can hold the hand grips and maintain the firearm 1 in a firing position orientation (FIG. 1). In this manner, the user does not have to adjust or change his body position or the position of the firearm 1 when reloading the firearm 1.

[0038] FIG. 3 illustrates the example barrel assembly 20 in a loading position in which the cover 44 is in an open position relative to the breech block 42 to allow access to the cartridge chamber 32. The cover 44 is pivoted away from the breech block 42 so that the cartridge chamber 32 is accessible (FIG. 4). With the cover 44 in the open position, a previously fired, empty cartridge can be removed and the ammunition 5' (e.g., a 25 mm cartridge) can be introduced into the barrel 21. The axis of the pin 45 is parallel to the axis 3 when the barrel assembly 20 is in the loading position shown in FIG. 3.

[0039] FIG. 4 illustrates the barrel assembly 20 in the loading position, but having the cover 44 in a closed position. Referring also to FIG. 4, the breech block 42 includes a retaining flange 47 (FIG. 2) to retain the cover 44 in the closed position. When the cover is in the closed position as shown in FIG. 4, an inner surface of the cover 44 provides a breech block, which is axially fixed in a direction along the axis 3 via the retaining flange 47. As most clearly shown in FIG. 5 and as noted above, the cover 44 includes the spring 48 (e.g., a leaf spring) to axially align the firing pin head 49 with the axis 3. The cover 44 can be manually moved to the closed position as shown in FIG. 3 and the barrel assembly 20 can be swiveled to the firing position (i.e., received by the first frame portion 2) as shown in FIG. 1.

[0040] Alternatively, the cover 44 may be moved to the closed position automatically as the barrel assembly 20 is pivoted toward first frame portion 2 in the firing position (FIG. 1). A bottom rim 44a of the cover 44 engages an edge 2a of the first frame portion 2 when the barrel assembly 20 is moved to the firing position. The edge 2a engages the bottom rim 44a of the cover 44 to cause the cover 44 to pivot to the

closed position and engage the retaining flange 47. Thus, the edge 2a and the rim 44a provides an automated safety feature to ensure that the cover 44 is properly in the closed position when the barrel assembly 20 is pivoted or moved to the firing position provided that the ammunition 5' is properly loaded within the cartridge chamber 32 (or the cartridge chamber 32 is empty). As discussed in greater detail below, the firearm 1 includes a locking mechanism to securely hold or retain the barrel assembly 20 to the first frame portion 2.

[0041] In operation, when the firearm 1 is discharged, a recoil effect causes the cartridge chamber 32 to move toward the support region 5 (in a rearward direction in the orientation of FIG. 2) against the inner surface of the cover 44, which is axially fixed to the breech block 42 via the hinge 47. The breech assembly 40 engages the plate 62 at the plane 50 and moves or pushes the damper apparatus 60 toward the support region 5 of the first frame portion 2 (in a rearward direction in the orientation of FIG. 2). As the damper apparatus 60 moves toward the support region 5, the damping elements 72 of the recoil spring 70 are compressed and the guide elements 71 slide along the outer surface of the guide sleeve 64 through the hysteresis effect of the damping elements 72. The recoil spring 70 elastically deforms to dampen the recoil effect experienced by the firearm 1 during discharge. Additionally, friction between the damping elements 72 and the outer surface of the guide sleeve 64 provides additional damping.

[0042] Thus, when fired, the recoil effect causes the barrel 21 to move toward the support region 5 (toward the rear of the firearm 1 in the orientation of FIG. 2). In turn, the breech assembly 40 causes the damper apparatus 60 to move toward the support region 5 of the first frame portion 2. When the breech assembly 40 and the damper apparatus 60 are moving toward the rear of the firearm 1, the guide sleeve 64 moves through an opening in the support region 5 and engages or presses against the hammer 13 via the adjusting head 66. In this manner, the hammer 13 is moved to a cocked position ready for firing after the cartridge chamber 32 is reloaded without having to manually move the hammer 13 to the cocked position. As shown, the firearm 1 includes a safety shaft 15 that may be rotated to engage a safety catch to provide a safety and prevent undesired firing of the firearm 1.

[0043] After the adjusting head 66 has reached its rear most position, the recoil spring 70 moves the plate 62 toward the muzzle end of the barrel 21, thereby causing the breech assembly 40 and the barrel 21 to move toward the muzzle end of the barrel 21 to a rest or starting position. As the barrel 21 moves toward the starting position, an annular spring element 74 dampens the impact of the adjusting head 66 against the support region 5. Also, the buffer ring 28 dampens the impact of the guide sleeve 23 on the muzzle end region such as, for example, on a front end of the mounting sleeve 22. Thus, the spring element 74 and/or the buffer ring 28 provide a cushioning effect to dampen the recoil effect toward the front (the muzzle end) of the firearm 1. Thus, the firearm 1 is configured to dampen recoil effect caused by the components of the firearm 1 moving toward the rear end of the firearm 1 and dampen recoil effect caused by the components of the firearm 1 moving forward toward the muzzle end of the barrel 21. Such configuration significantly reduces mechanical stresses imparted on the firearm 1 as the components of the firearm 1 move when the firearm 1 is discharged.

[0044] To reload the firearm 1, the barrel assembly 20 is unlocked, unlatched, or released from the first frame portion 2 and pivoted laterally relative to the first frame portion 2

about the hinge pin 24 as shown in FIG. 3. The spring 25 maintains the barrel 21 axially aligned about the axis 3 and the pivot spring 30 maintains or holds the barrel 21 in the loading position shown in FIG. 3. The cover 44 is pivoted about the pin 45 away from the retaining flange 47 of the breech block 42 to the open position so that the cartridge chamber 32 is accessible. The previously fired (empty) cartridge is removed and a new cartridge is loaded.

[0045] As noted above, the firearm 1 is implemented with a locking mechanism to retain the barrel assembly 20 coupled with the first frame portion 2 of the firearm 1. FIG. 7 illustrates an example locking mechanism of the firearm 1.

[0046] Referring to FIGS. 1-7, the breech block 42 includes a latch 80 that engages a corresponding detent or recess in the first frame portion 2 to lock the barrel assembly 20 in the firing position as shown in FIG. 1. The latch 80 is spring-loaded so that the latch 80 automatically engages the detent in the first frame portion 2 when the barrel assembly 20 is moved to the firing position. Alternatively, the latch 80 can be manually moved to a locked position via a slide lock 84 (FIG. 6) and a bolt 86 (FIG. 5). As most clearly shown in FIG. 6, the slide lock 84 is coupled to the first frame portion 2 opposite the pivot path of the barrel assembly 20.

[0047] More specifically, as most clearly shown in FIGS. 7 and 8, a locking nose 88 protruding inward from the side wall of the first frame portion 2 opposite the slide lock 84 presses or engages the bolt 86 (shown in FIGS. 3, 4, and 5) protruding from the breech block 42. To lock the latch 80, a user can slide the slide lock 84 to cause the locking nose 88 to engage or move the bolt 86. The bolt 86 engages the latch 80 to cause the latch 80 to engage the detent in the first frame portion 2. The position of the slide lock 84 also indicates to the user whether the firearm 1 is properly locked (FIG. 6). Such configuration provides added safety to ensure that the barrel assembly 20 is in the locked position (FIG. 1) when, for example, the spring-loaded latch 80 is damaged or inoperable (e.g., due to accumulation of dirt).

[0048] As most clearly shown in FIGS. 7 and 8, a pivot lever 90 is used to activate or unlock the latch 80 from the detent of the first frame portion 2 and unlock or disengage the barrel assembly 20 from the first frame portion 2. The lever 90 pivots about a pivot pin 92 having an axis substantially perpendicular to the axis 3 of the first frame portion 2. The pivot lever 90 acts on a bottom surface of the latch 80 to retain the latch 80 in a locked position. The lever 90 includes a button portion 94 that may be used to activate or pivot the lever 90 to release the latch 80 and unlock the barrel assembly 20 from the first frame portion 2. The button 94 protrudes from the first frame portion 2 adjacent the trigger 10 and can be activated by a user's trigger finger. When activated, a release latch 96 of the pivot lever 90 engages or acts on the latch 80 (e.g., moves it upward) so that the latch 80 disengages from a detent or recess of the first frame portion 2. When the latch 80 is in the unlocked position, the barrel assembly 20 can pivot or swing outward relative to the first frame portion 2 about the hinge pin 24.

[0049] FIG. 8 illustrates the first frame portion 2 with the barrel assembly 20 removed from the first frame portion 2. Referring to FIGS. 7 and 8, a stop 100 is coupled to the first frame portion 2. The stop 100 limits or restricts the pivotal path of the barrel assembly 20 when the barrel assembly 20 is unlocked relative to the first frame portion 2. The stop 100 is rotatably coupled to the first frame portion 2 and has an axis substantially perpendicular to the axis 3. The stop 100

includes a head portion **102** having a projecting rim **101** that protrudes into the swivel path of the barrel assembly **20**. The stop **100** also includes a spring catch **104** opposite the head portion **102**. To decouple the barrel **21** from the first frame portion **2**, the stop **100** is turned or rotated (e.g., by 180°) so that a flat or key portion **106** does not interfere with the swivel path of the barrel assembly **20**.

[0050] The first frame portion **2** is configured to accommodate or receive differently sized barrel assemblies. For example, the firearm **1** can receive a barrel assembly for use with 25 mm caliber ammunition, a barrel assembly for use with 40 mm caliber ammunition, or any other suitable barrel assembly. When interchanging the barrel assembly, the breech assembly and/or the damper apparatus **60** can also be interchanged to accommodate differently sized barrel assemblies. Also, if necessary, the recoil spring **70** can be interchanged according to the momentum or recoil effect generated by the type of ammunition used.

[0051] Although certain example methods and apparatus have been described herein, the scope of coverage of this patent is not limited thereto. On the contrary, this patent covers all methods, apparatus and articles of manufacture fairly falling within the scope of the appended claims either literally or under the doctrine of equivalents.

What is claimed is:

1. A large caliber, small arm firearm, comprising:
a barrel assembly mounted in a frame of the firearm; and
a damper apparatus axially disposed between a breech assembly and a portion of the frame of the firearm opposite a muzzle end of the barrel assembly, wherein the damper apparatus is operatively coupled to the barrel assembly and slidably receives a firing pin guide.
2. A firearm of claim 1, wherein the barrel assembly is movably disposed within a receptacle of the frame and is pivotably mounted to the frame so that the barrel assembly pivots about a swivel hinge between a reloading position and a firing position, wherein the swivel hinge is substantially perpendicular to an axis of the bore.
3. A firearm of claim 1, wherein the damper apparatus comprises an elastomeric spring to dampen a recoil effect experienced by the firearm when the firearm is discharged.
4. A firearm of claim 1, further comprising a cushioning element disposed between a head portion of a firing pin guide and a portion of the frame, wherein the cushioning element axially opposes the damper apparatus.
5. A firearm of claim 4, wherein the head portion of the firing pin guide engages a hammer of a trigger assembly and moves the hammer to a cocked or ready to fire position during a recoil effect imparted on the firearm during discharge.
6. A firearm of claim 1, further comprising a breech block assembly coupled to the barrel assembly and having a cover that pivots between an open position and a closed position about a pin disposed parallel relative to an axis of the barrel assembly.

7. A firearm of claim 6, wherein the cover engages a portion of the frame and moves to the closed position when the barrel assembly is moved from a loading position to a firing position.

8. A firearm of claim 7, wherein the cover further comprises a firing pin head.

9. A firearm of claim 8, wherein a breech block and the firing pin head of the breech assembly axially align with the damper apparatus when the barrel assembly is in the firing position.

10. A firearm of claim 1, further comprising a catch assembly to lock the barrel assembly in the firing position relative to the frame.

11. A firearm of claim 10, wherein the catch assembly is operatively coupled to a latch to manually move the catch to a locked position.

12. A firearm of claim 1, wherein the frame is configured to receive a first barrel assembly that is sized to receive a first caliber ammunition or a second barrel assembly that is sized to receive a second caliber ammunition different from the first caliber ammunition.

13. A firearm of claim 1, wherein the firearm is removably coupled to a second firearm via an interface apparatus of the frame.

14. A firearm of claim 1, wherein the firearm is a grenade launcher.

15. A large caliber firearm, comprising:

- a barrel assembly pivotally coupled to a frame of the firearm;
- a breech assembly coupled to the barrel assembly opposite a muzzle end of a barrel; and
- a damper apparatus disposed between the breech assembly and a portion of the frame, the damper apparatus is spaced from and operatively coupled to the barrel assembly and provides recoil damping imparted on the firearm during discharge.

16. A firearm as described in claim 15, wherein the barrel assembly pivots about a hinge pin in a lateral direction relative to the frame between a loading position and a firing position.

17. A firearm as described in claim 15, wherein the damper apparatus comprises elastomeric springs alternately arranged relative to damping rings.

18. A firearm as described in claim 15, wherein a plate having a firing pin guide protruding therefrom operatively couples the damping apparatus, the barrel assembly, and the breech assembly.

19. A firearm as described in claim 18, wherein the firing pin guide is slidably coupled to the damping apparatus.

20. A firearm as described in claim 19, wherein a head portion is threadably coupled to an end of the firing pin guide opposite the plate to engage a hammer of the firearm during a recoil effect when the firearm is discharged.

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